Special Issue: Against stored abstractions:
A radical exemplar model of language acquisition

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Anti-representationalism in language development research: A commentary on Ambridge (2020)

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Abstract
Ambridge argues that there is widespread agreement among child language researchers that learners store linguistic abstractions. In this commentary the authors first argue that this assumption is incorrect; anti-representationalist/exemplar views are pervasive in theories of child language. Next, the authors outline what has been learned from this body of work, including insights into mechanisms underlying language learning. Interestingly, some of these mechanisms are at odds with counterarguments in Ambridge, such as the finding that forgetting is a critical process of language.

Keywords
Abstraction, anti-representationalism, child language acquisition, exemplar account, forgetting-as-abstraction, word learning

A central claim of Ambridge (2020) is that 'when it comes to the question of stored abstractions, there is widespread agreement' among language development researchers; namely, that 'all sides agree' that we 'possess stored linguistic abstractions' (p. 510). As language development researchers, we concur with Ambridge that learning language does not require stored abstractions, and we disagree with his claim that there is agreement in developmental science. Indeed, many language development researchers have adopted anti-representationalist approaches, including radical exemplar theories.

To understand the genesis of exemplar theories in language development research, we must consider anti-representationalist theories in cognition at large. Anti-representationalist views opposed the classical notion of cognition as symbolic representation (Chemero, 2000). According to the symbolic view, cognitive processes like

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perception and attention operate over representations of knowledge. Thus, a clear distinction between structure and process was made. It is against this theoretical backdrop that language development researchers have made a similar, radical claim: there are no structures, there is only process (Samuelson et al., 2015; Smith & Heise, 1992; Spencer et al., 2012). Specifically, cognition emerges from simple, lower-level, and non-symbolic processes (Colunga & Smith, 2008; Smith & Samuelson, 2003). This means that knowledge is not separable from, but instead emerges from, basic cognitive processes like perception, attention, and memory.

Extreme anti-representationalist views (i.e., no exemplars, only process) and exemplar models (i.e., exemplar models like Ambridge, 2020) have been applied broadly in research on language development. They have provided explanations for several phenomena related to word learning, including the shape bias (Smith, 2000), referent selection (Kucker et al., 2015), word-object mappings (Samuelson et al., 2011), as well as categorization and generalization (Colunga & Smith, 2008; Smith & Heise, 1992; Smith & Samuelson, 1997).

Language development researchers have adopted anti-representational models for several reasons. First, a focus on process allows researchers to identify mechanisms of change (Smith & Samuelson, 2003). For instance, novel noun generalization has been ascribed to basic attentional processes in which children track regularities between exemplars (Colunga & Smith, 2008). When encountering new exemplars, attention is dynamically shifted to features relevant to the learner. Thus, changes across time and contexts are ascribed to changes in attention. Second, this approach views language learning as a dynamic set of processes, and explains how past learning events affect learning in-the-moment. For instance, Horst et al. (2011) demonstrate how children's object-word mappings are initially driven by novelty. As children acquire words and refine their lexicon, the pull to novelty is attenuated. Indeed, a strength of exemplar accounts noted by Ambridge (2020) is their accommodation of context and past learning. Finally, these theories are considered domain-general, extending beyond the domain of language. For instance, dynamic systems theories – a specific instantiation of anti-representationalism – have been used to explain infants' perseverative reaching in the A-not-B error (Smith & Thelen, 2003; Thelen et al., 2001). Thus, these models allow us to identify mechanisms that bridge language and other domains of cognition.

Interestingly, this work provides several counterarguments to mechanisms proposed in Ambridge (2020). For instance, Ambridge (2020) proposes that learners 'analogize across [stored exemplars] on the fly' to categorize and generalize 'in-the-moment' (pp. 3, 7). We are not quite clear on the use of the term 'analogize' in this context; the article does not provide a clear operational definition and we think of this term as it is used in analogical processing research (Gentner, 1983). If Ambridge (2020) proposes a similar definition to this body of work (Gentner et al., 2001; Goswami, 2013), then we would argue that mechanisms much lower-level than analogizing can explain language. Indeed, many language development researchers have demonstrated that infants can track regularities in their environment using simple associative learning, which contributes to several aspects of language acquisition (e.g., phonology, prosodic patterns, grammar, word learning; Krogh et al., 2013; Saffran et al., 1996; Smith & Yu, 2009).

As another example, Ambridge (2020) claims that forgetting is not a critical process in language learning. In fact, the article notes that 'some exemplar models (e.g., LEX,

TiMBL) do not incorporate an explicit forgetting mechanism (except indirectly in the form of interference in memory, which arises simply as a consequence of storing more and more exemplars)' (p. 45). However, recent language development research has shown that forgetting is a critical mechanism underlying word learning and categorization (Vlach, 2014, 2019). According to the *forgetting-as-abstraction* theory (Vlach, 2014), the time between word learning events provides an opportunity for language learners to forget information about words and referents. This forgetting makes retrieval of learned information more effortful and challenging in the future, which would seem to deter language learning. However, engaging in more effortful retrieval in turn strengthens the memory trace, slowing future forgetting of words and referents. That is, every time words and referents co-occur, they are reactivated in memory and are thus forgotten at a slower rate. Words and features relevant to category membership appear more frequently across learning events relative to irrelevant information. Thus, irrelevant, low frequency features of the exemplars are forgotten at a faster rate than relevant, high frequency features. In turn, relevant features are then more readily retrieved in the future, improving generalization. In sum, forgetting accelerates the abstraction of frequent, relevant features (Vlach, 2014), and abstraction need not imply endorsement of a prototype theory. In fact, the forgetting-as-abstraction account resembles components of the Ambridge (2020) explanation of the exemplar account: forgetting simply means decreased access to a memory trace or greater interference of exemplars.

In sum, we – child language researchers – concur with Ambridge (2020) that language does not necessitate stored abstractions. As reviewed above, many of our colleagues have argued the same position. Thus, one of the premises of Ambridge (2020) is a strawman argument; any reader should be made aware that there is not widespread agreement among language development researchers. We urge the author to consider these anti-representationalist/exemplar theories, and subsequently outline how the proposed model contributes anything new to the field of child language research.

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